Solar–Piezo–Thermo–Tribo Layered Energy System

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🧾 Abstract

This invention describes a multi-modal, layered energy harvesting system that integrates **solar**, **piezoelectric**, **thermoelectric**, and **triboelectric** modules into a unified architecture. Designed for deployment across urban surfaces, autonomous devices, and wearable tech, the system captures light, motion, heat, and friction to generate clean, decentralized power. The synergy between layers enables adaptive energy routing, scalable output, and long-duration storage for off-grid and regenerative environments.

🧱 Layer Architecture

Layer	Function	Energy Source
Top Layer	Triboelectric	Friction from wind, rain, human contact
Second Layer	Piezoelectric	Mechanical stress, vibration, motion
Third Layer	Thermoelectric	Heat differentials from ambient environment
Base Layer	Solar Photovoltaic	Sunlight and ambient illumination

Synergy:

- Triboelectric surges activate piezoelectric strain
- Piezoelectric motion amplifies thermal gradients
- Thermoelectric flow stabilizes and stores residual energy
- Solar layer provides continuous baseline power

⚙️ System Enhancements

- **Dynamic Layer Switching**: MEMS-based logic reroutes energy flow based on environmental input
- **Thermal Management**: Phase-change materials and heat spreaders optimize thermoelectric performance
- **Hybrid Storage**: Combines supercapacitors (for fast surges) and solid-state batteries (for long-term storage)

- **AI Microcontroller**: Maps real-time exergy and prioritizes energy routing across layers
- **Modular Expansion Ports**: Snap-fit or magnetic connectors allow chaining multiple units

⚙️ Exergy Cascade Logic

- **Domino Activation**: Environmental triggers sequentially activate layers
- **Self-Tuning Feedback**: Sensors monitor vibration, temperature, light, and friction
- **Adaptive Reconfiguration**: Layers shift or reroute based on input conditions

🌍 Use Cases

Application	Description
Smart Pavement	Harvests foot traffic, sunlight, and ambient heat
Wearables	Converts body motion, temperature, and light into power
Urban Furniture	Powers kiosks, benches, and lighting
Autonomous Drones	Extends flight time using motion, solar, and thermal harvesting
Smart Agriculture	Powers soil sensors using light, vibration, and heat

Claims

1. A multi-layered energy harvesting device comprising solar, piezoelectric, thermoelectric, and triboelectric modules arranged to trigger sequential energy conversion.
2. The system of claim 1, wherein environmental feedback activates a domino-effect energy cascade.
3. The system of claim 1, further comprising MEMS-based switching for dynamic energy routing.
4. The system of claim 1, wherein hybrid energy storage includes supercapacitors and solid-state batteries.
5. A method for autonomous energy harvesting using embedded sensors to inform routing logic and layer prioritization.

📜 Statement of Intent

This document serves as a public timestamp and declaration of authorship. The inventor intends to develop, deploy, and license this technology under open-source and DAO-governed frameworks. This publication establishes

prior art and blocks others from patenting this concept without substantial novelty.

□ Attribution

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